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10/525,706	06/22/2005	Hong Koo Kim	076333-0360	5899

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EXAMINER	
VAN, LUAN V	

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1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/525,706	Applicant(s) KIM ET AL.	
	Examiner LUAN V. VAN	Art Unit 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 July 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *22-33,35-38,42,52 and 53* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *22-33,35-38,42,52 and 53* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on July 9, 2008 has been entered.

Response to Amendment

Applicant's amendment of July 9, 2008 does not render the application allowable.

Status of Objections and Rejections

The rejection of claims 39-41 and 43-51 is obviated by Applicant's cancellation.

All other rejections are maintained.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 22-27, 32, 36-38, 42, 52 and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkura et al. (US patent 6610463).

Regarding claims 22 and 42, Ohkura et al. teach a method of making a nanopore array with a controlled first pattern, comprising: providing a substrate 2 (Fig. 1) comprising a first surface having a first pattern 1 (Fig. 1E1); depositing a first material 11 (Fig. 1F1) capable of forming nanopores onto said first surface having the first pattern; and anodically oxidizing (column 8 line 54) said first material to form the nanopore array 14 with the controlled first pattern in the anodically oxidized first material.

Ohkura et al. differ from the instant claims in that the reference does not explicitly teach anodizing the first material under a first and a second condition.

However, Ohkura et al. teach "in the formation of pores by anodizing, **the intervals between the pores can be controlled to some degree through the setting of process conditions**, i.e., the kind, concentration and temperature of an electrolytic solution used for anodizing, **the method of applying an anodizing potential, the potential value**, time, etc. Accordingly, it is preferable to design a 'recess-projection

pattern' (recesses, in particular) with pore intervals presupposed from the process conditions" (column 7 lines 50-57). In addition, Ohkura et al. teach that the "anodizing potential, temperature, and other anodizing conditions according to the respective electrolytic solution can be set as desired with respect to the nanostructure to be made" (column 9 lines 14-17), and that the "structure having pores, formed by the above-described anodizing, may be processed by pore-widening... to increase the diameter of the pores as desired" (column 9 lines 18-22).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al. by anodically oxidizing the aluminum using different voltages in order to control the intervals between the pores as suggested by Ohkura et al. (column 7 lines 50-57). Furthermore, since Ohkura et al. teach that the structure having pores may be further processed by pore-widening, it would have been obvious to one having ordinary skill in the art to have used a second oxidizing condition in order to change the diameter of the pores as suggested by Ohkura et al. (column 9 lines 18-22). A plurality of separated cells would be formed as a result of the different applied voltages because the intervals spacing between the porous would be changed. The examiner notes that the first and second condition is not necessarily limited to the voltage, and therefore using a different solution, such as the additional acid solution for pore-widening in Ohkura et al., would also read on the second condition of the instant claim.

Regarding claim 23, Ohkura et al. teach further comprising: forming a photoresist layer 3 (Fig. 1D1) on the first surface; patterning the photoresist layer to form a

patterned photoresist layer; and etching the first surface (column 8 lines 8-26) using the photoresist layer as a mask to form the first pattern in the first surface.

Regarding claim 24, Ohkura et al. teach wherein the step of patterning the photoresist layer comprises holographically exposing (i.e., interference lithography, column 3 lines 11-22) the photoresist layer and selectively removing (via development, column 7 lines 34-35) portions of the photoresist layer after the exposing step to form a controlled photoresist pattern.

Regarding claim 25, Ohkura et al. teach wherein the step of holographically exposing comprises holographically exposing the photoresist layer a plurality of times while rotating (column 7 lines 26-33) the substrate and the exposing beam relative to each other between exposures to form a controlled three dimensional pattern in the photoresist layer.

Regarding claim 26, Ohkura et al. teach wherein the first material 1 contains first depressions 10 which correspond to second depressions 12 in the first pattern in the first surface of the substrate and the nanopores 14 are selectively formed in the first depressions.

Regarding claim 27, Ohkura et al. teach wherein the first material comprises an anodically anodizable metal, i.e. aluminum (column 8 lines 41-42).

Regarding claim 32, Ohkura et al. teach wherein the step of filling comprises selectively filling the nanopores with a metal by electroplating (column 12 lines 39-42).

Regarding claim 36, Ohkura et al. differ from the instant claims in that the reference does not explicitly teach depositing a metal film on the first for the resist

pattern. However, Ohkura et al. teach the "material of a film used to form a 'recess-projection pattern' (second layer) in the above-described form (1) or (3) is, for example, a positive resist, or a negative resist, and may be selected from other various materials. SiO2 is used in the process described below" (column 6 lines 7-11). It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al. depositing a metal film on the resist pattern material instead of the silicon dioxide material as suggested by Ohkura et al. in order to form the recess-projection pattern and to promote the formation of nanopores corresponding to the pattern of the underlying film.

Regarding claims 37 and 38, Ohkura et al. differ from the instant claims in that the reference does not explicitly teach using a hard mask to etch the substrate. However, Ohkura et al. teach using a photoresist pattern 15 (Fig. 2B1) to etch the substrate.

The examiner takes Official Notice that it is well known to use a hardmask for etching a substrate.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al. by replacing the photoresist with a hardmask, because a hardmask would provide greater etch resistance than the photoresist, thus allowing the substrate to be etched for a longer time. With respect to forming a second resist pattern in claim 38, Ohkura et al. teach exposing the substrate is second time at a different angle (column 7 lines 26-33).

Therefore, a second resist pattern is formed when the resist is exposed a second time at a different angle.

Regarding claims 52 and 53, since Ohkura et al. teach that the "anodizing potential, temperature, and other anodizing conditions according to the respective electrolytic solution can be set as desired with respect to the nanostructure to be made" (column 9 lines 14-17), it would have been obvious to one having ordinary skill in the art to have performed either the first or second condition before the other in order to form a nanostructure having the desired pore shape.

Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkura et al. in view of Zhang et al. (US patent 6709929).

Ohkura et al. teach the method as described above. Ohkura et al. differ from the instant claims in that the reference does not explicitly teach using the anodically oxidized the first material as a mask.

Zhang et al. teach a method of forming a nano-scare electronic and optoelectronic devices including etching an anodized aluminum oxide thin film and using the anodic aluminum oxide layer as an etch mask (column 13 lines 23-25).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al. by using the anodized aluminum oxide as the etch mask as taught by Zhang et al., because it would enable nanopores to be formed on a substrate material other than the aluminum oxide layer. It would have been obvious to one having ordinary skill in the art to have further modified

the method of Ohkura et al. by removing the anodic aluminum oxide in order to expose the nanopores on the substrate material.

Claims 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkura et al. in view of Zhang et al., and further in view of Iwasaki et al. (US patent 6278231).

Ohkura et al. and Zhang et al. teach the method as described above. Ohkura et al. differ from the instant claims in that the reference does not explicitly teach filling the nanopores with a second material.

Iwasaki et al. teach a method of forming a nanostructure including an anodized film comprising nanoholes, wherein cobalt and copper or electrodeposited inside the nanoholes into the form of a multilayer inclusion to produce a giant magnetoresistive device capable of responding to a magnetic field (column 12 lines 10-20).

Regarding claim 29, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al., and Zhang et al. by depositing a second material in the nanopores as taught by Iwasaki et al., because it would form a multilayer giant magnetoresistive device capable of responding to a magnetic field.

Regarding claim 30, it would have been obvious to one having ordinary skill in the art to have modified the method of Ohkura et al., and Zhang et al. by contacting the second material with a solid state device as taught by Iwasaki et al., because it would

enable an electrical signal to be read from or write to the multilayer giant magnetoresistive device.

Claims 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkura et al. in view of Iwasaki et al. (US patent 6278231).

Ohkura et al. teach the method as described above. Ohkura et al. differ from the instant claims in that the reference does not explicitly teach filling the nanopores with a second material or vapor depositing on the metal located in the nanopores.

Iwasaki et al. teach a method of forming a nanostructure including an anodized film comprising nanoholes, wherein cobalt and copper or electrodeposited inside the nanoholes into the form of a multilayer inclusion to produce a giant magnetoresistive device capable of responding to a magnetic field (column 12 lines 10-20). Furthermore, Iwasaki et al. teach that the inclusion in the nanoholes can be formed by CVD, or chemical vapor deposition (column 11 lines 61-67).

Regarding claim 31, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al. by depositing a second material in the nanopores as taught by Iwasaki et al., because it would form a multilayer giant magnetoresistive device capable of responding to a magnetic field.

Regarding claim 33, it would have been obvious to one having ordinary skill in the art to have modified the method of Ohkura et al. by vapor depositing on the metal

located in the nanopores as taught by Iwasaki et al., because it would enable the nanopores to be formed in a dry vacuum environment.

Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ohkura et al. in view of Sekinger et al. (US patent 5975976).

Ohkura et al. teach the method as described above. Ohkura et al. differ from the instant claims in that the reference does not explicitly teach placing a conformal template material into the nanopores and removing the template material.

Sekinger et al. teach forming an anodic aluminum oxide mold body having pores, placing a conformal template material 14 (Fig. 3-4), and removing the template material containing the ridges from the nanopores (Fig. 4).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Ohkura et al. by placing a conformal material in the nanopores and removing the template material as taught by Sekinger et al., because it would form a well-defined emitter structure having the shape of the mold body.

Response to Arguments

The applicant argues on page 7 of the Remarks that Ohkura et al. is directed to the fact that one condition out of many can be chosen to anodize a substrate and that Ohkura et al. do not suggest using multiple process conditions on the same substrate, much less suggest using different conditions. The examiner respectfully disagrees with

this characterization. As described above, Ohkura et al. teach "in the formation of pores by anodizing, the intervals between the pores can be controlled to some degree through the setting of process conditions, i.e., the kind, concentration and temperature of an electrolytic solution used for anodizing, the method of applying an anodizing potential, the potential value, time, etc." (column 7 lines 50-57). This teaching in general is not necessarily limited to one condition for a single substrate as interpreted by the applicant. In fact, Ohkura et al. teach that an additional step to change the diameter of the pores by "pore-widening" (column 9 lines 18-22) is performed, therefore changing the interval spacing between the pores. Since the intervals between the pores can be controlled by changing the voltage, it would have been obvious to one having ordinary skill in the art to use different voltages to achieve the same result. Furthermore, the applicant argues that the conditions are different; however, the first and second conditions as presently claimed are not necessarily different.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luan V. Van whose telephone number is 571-272-8521. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Nam X Nguyen/
Supervisory Patent Examiner, Art
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LVV
July 28, 2008